CLAIMS

We claim:

1. A method for fabricating a light-emitting semiconductor device including a III-Nitride quantum well layer, said method comprising:

selecting a facet orientation of said III-Nitride quantum well layer to control a field strength of a piezoelectric field therein; and

growing said III-Nitride quantum well layer with said selected facet orientation.

2. The method of Claim 1, further comprising selecting said facet orientation to reduce a magnitude of an electric field strength in said quantum well layer.

3. The method of Claim 1, further comprising growing said quantum well layer with a wurtzite crystal structure with said selected facet orientation tilted at least 1° from the {0001} direction of said wurtzite crystal structure.

4. The method of Claim 1, further comprising growing said quantum well layer with a wurtzite crystal structure with said selected facet orientation tilted at least 10° from the {0001} direction of said wurtzite crystal structure.

5. The method of Claim 1, further comprising growing said quantum well layer with a wurtzite crystal structure with said selected facet orientation tilted from the {0001} direction of said wurtzite crystal structure at an angle selected from about 30° to about 50°, about 80° to about 100°, and about 130° to about 150°.

6. The method of Claim 1, further comprising growing said quantum well layer with a zincblende crystal structure with said selected facet orientation tilted at least 1° from the {111} direction of said zincblende crystal structure.

7. The method of Claim 1, further comprising growing a nucleation layer directly on a substrate surface, and growing said quantum well layer above said nucleation layer.

8. The method of Claim 7, further comprising selecting said substrate surface to have a lattice mismatch of less than about 10% with a material from which said nucleation layer is formed.

9. The method of Claim 7, further comprising growing said nucleation layer by metal-organic chemical vapor deposition at a temperature such that a crystal structure of said nucleation layer substantially replicates a crystal structure of said substrate surface.

10. The method of Claim 7, further comprising selecting a material from which said substrate is formed from the group consisting of SiC, AlN, and GaN.

11. The method of Claim 7, wherein said nucleation layer comprises a III-Nitride material.

12. The method of Claim 1, further comprising:

growing a first semiconductor layer above a substrate, said first semiconductor layer being grown with a first facet orientation different from said selected facet orientation;

altering an exposed surface of said first semiconductor layer to provide a surface having said selected facet orientation; and

growing said quantum well layer above said surface having said selected facet orientation.

13. The method of Claim 12, wherein altering said exposed surface comprises selectively etching said first semiconductor layer.

14. The method of Claim 12, further comprising growing a second semiconductor layer above said quantum well layer, said second semiconductor layer being grown with a facet orientation about equal to said first facet orientation.

15. A light-emitting semiconductor device comprising:

a III-Nitride quantum well layer having a wurtzite crystal structure and a facet orientation tilted from the {0001} direction of said wurtzite crystal structure at an angle selected from about 30° to about 50° and about 130° to about 150°.

16. The light-emitting semiconductor device of Claim 15 further comprising:

a substrate; and

a nucleation layer formed directly on a surface of said substrate;

wherein said quantum well layer is formed overlying said nucleation layer, and said nucleation layer has a crystal structure that substantially replicates a crystal structure of said surface of said substrate.

17. The light-emitting semiconductor device of Claim 16, wherein said surface of said substrate has a lattice mismatch of less than about 10% with a material from which said nucleation layer is formed.

18. The light-emitting semiconductor device of Claim 16, wherein said substrate comprises a material selected from the group consisting of SiC, AlN, and GaN.

19. The light-emitting semiconductor device of Claim 16, further comprising at least one layer having a facet orientation in about the {0001} direction.

20. A method for fabricating a light-emitting semiconductor device including a III-Nitride quantum well layer, said method comprising:

selecting a facet orientation of said III-Nitride quantum well layer to control a field strength of a spontaneous electric field therein; and

growing said III-Nitride quantum well layer with said selected facet orientation.

21. The method of Claim 20, further comprising selecting said facet orientation to reduce a magnitude of an electric field strength in said quantum well layer.

22. A method for fabricating a light-emitting semiconductor device including a III-Nitride quantum well layer, said method comprising:

selecting a facet orientation of said III-Nitride quantum well layer to reduce a magnitude of a combined field strength of a piezoelectric field and a spontaneous electric field therein; and

growing said III-Nitride quantum well layer with said selected facet orientation.

23. The method of Claim 22 further comprising growing said quantum well layer with a wurtzite crystal structure with said selected facet orientation tilted from the {0001} direction of said wurtzite crystal structure at an angle selected from about 80° to about 100°.